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Reichman et al.

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[54] **METHOD AND APPARATUS FOR REMOVING THE INNER CONDUIT FROM A DUAL PASSAGE DRILL STRING**

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[21] Appl. No.: **708,245**

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Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 661,368, Oct. 16, 1984, Pat. No. 4,624,327.

[51] **Int. Cl.**[4] **E21B 7/18;** E21B 17/18; F16L 17/00

[52] **U.S. Cl.** **175/67;** 175/215; 175/320; 285/376

[58] **Field of Search** ..... 175/320, 215, 57, 65, 175/67; 166/377; 285/18, 140–143, 401, 402, 376, 133 R

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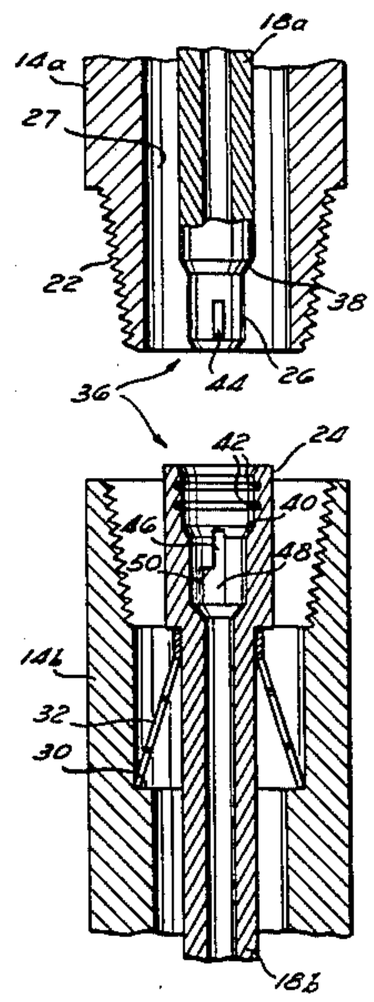
[57] **ABSTRACT**

A dual conduit drill string used in drilling holes for geothermal, oil and gas wells, and the like, comprises a removable inner conduit to permit the use of salvage or repair equipment within the outer conduit. The outer conduit comprises standard API drill pipe sections which are each slightly modified to receive the removable inner conduit sections. Each inner conduit section is provided with flexible hangers for suspending the weight of the inner conduit from a support ledge formed on the interior surface of the drill pipe. The hangers permit upward removal motion and rotation of the inner conduit with respect to the drill pipe, but prevent downward motion. Individual inner conduit sections are joined together at lockable stab joints in which locking is accomplished by the rotatable engagement of a key and locking socket. Preferably, the inner conduit is manufactured in uniform lengths and mounted in drill pipe sections of non-uniform lengths by means of drill pipe adaptor subs. In addition, a removal tool can be used to remove the inner conduit from the drill pipe by engaging the hangers of the lowest inner conduit.

19 Claims, 11 Drawing Figures



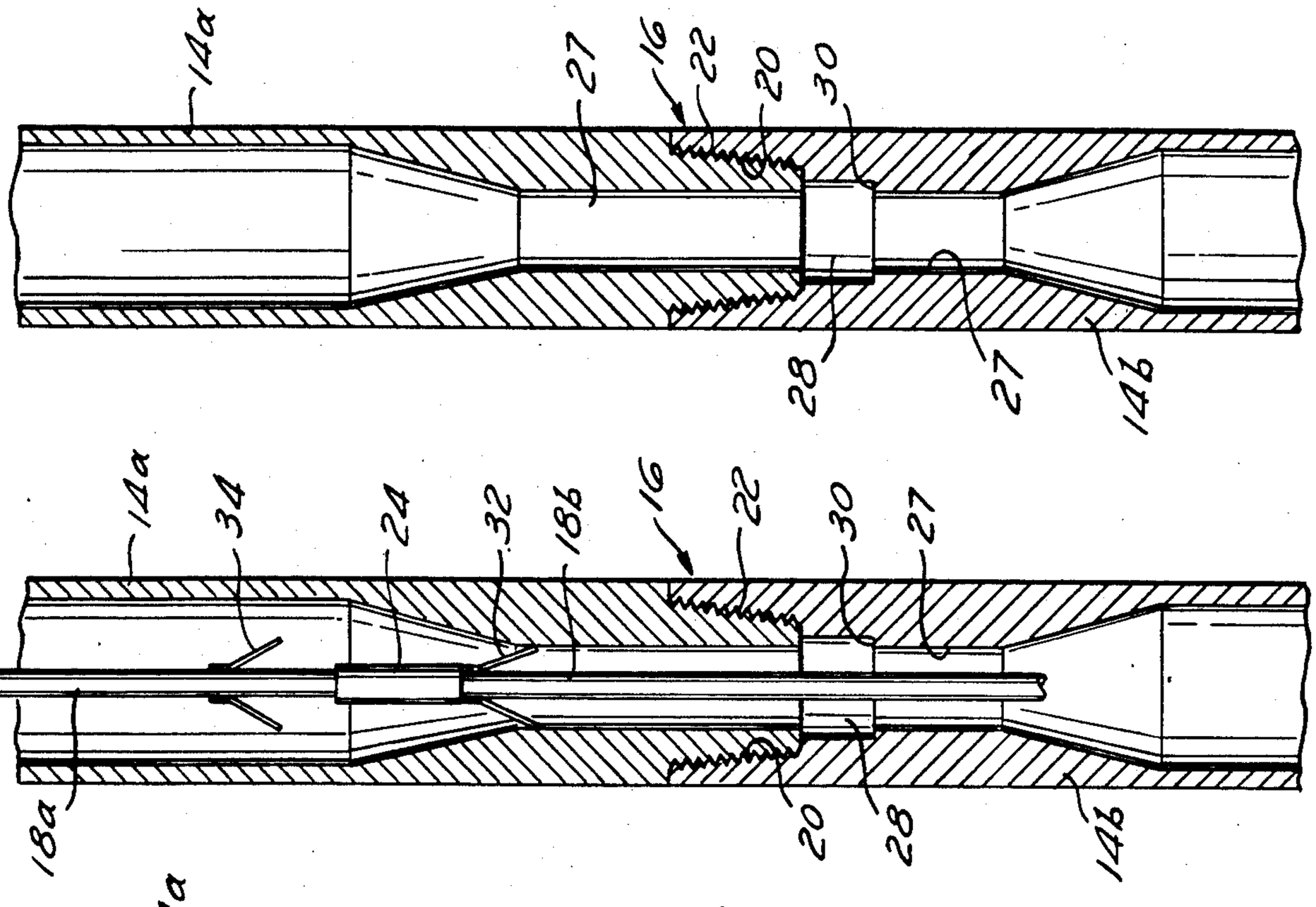


Fig. 5

Fig. 4

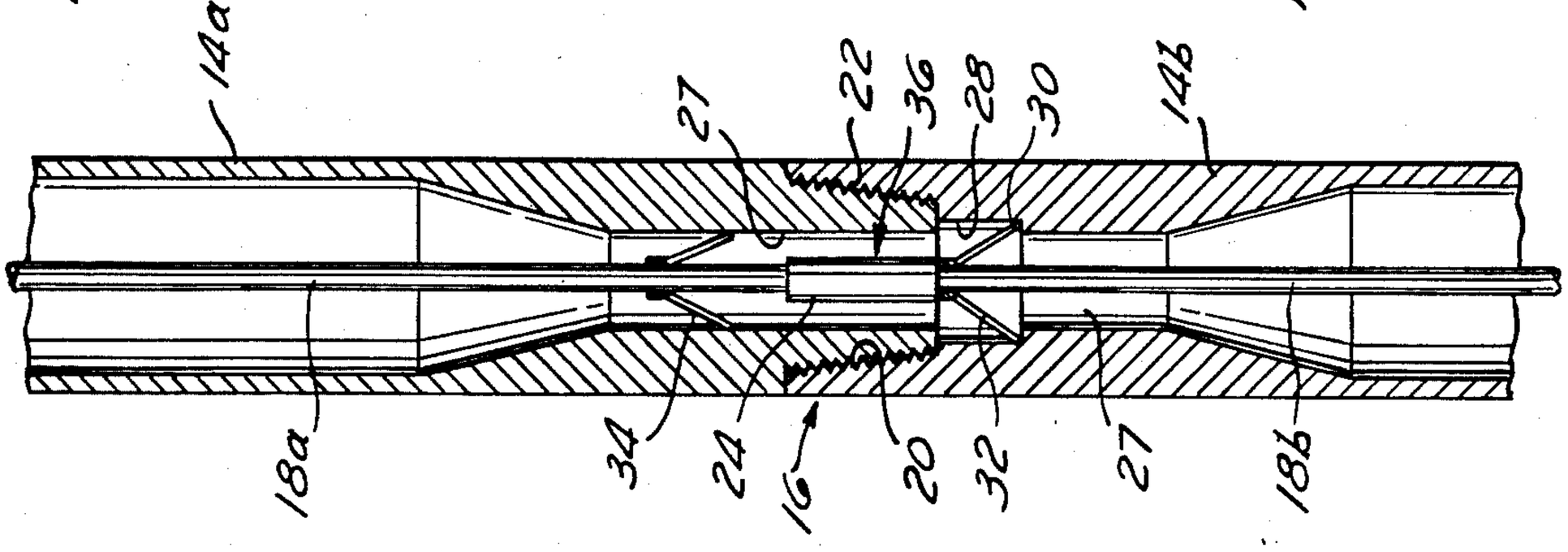


Fig. 3

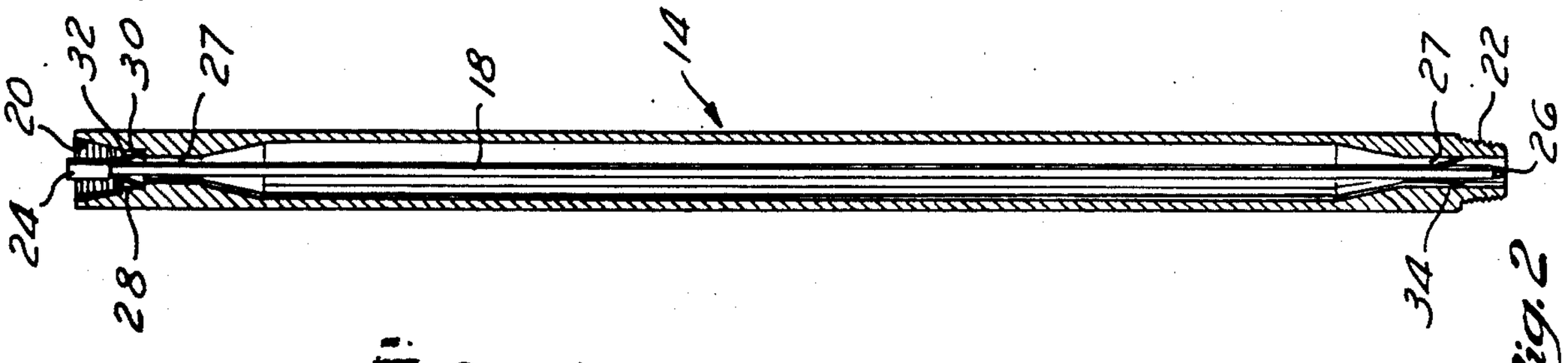


Fig. 2

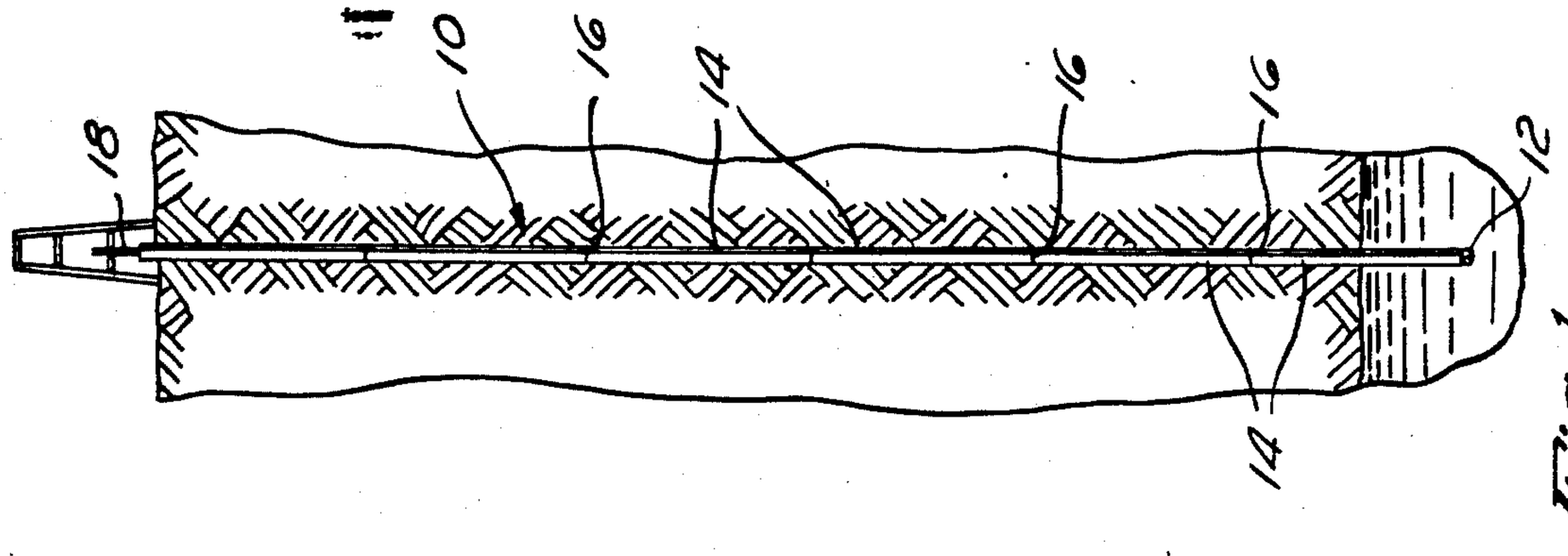


Fig. 1

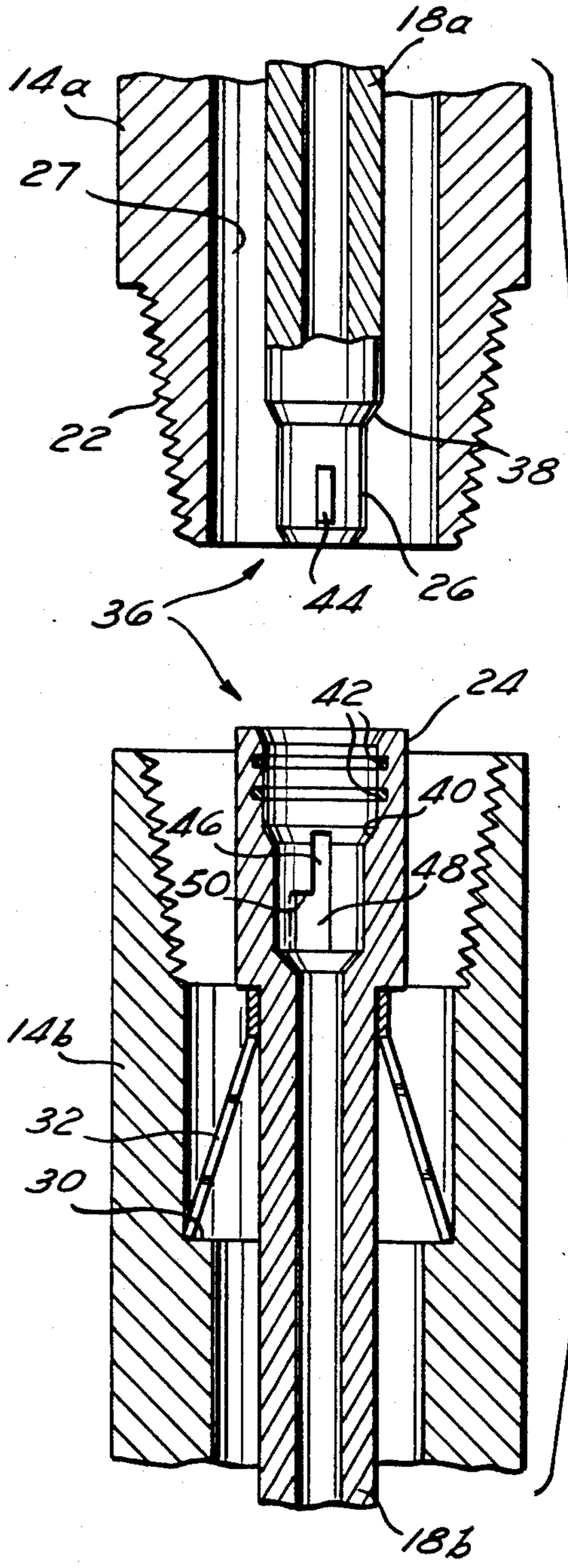


Fig. 6

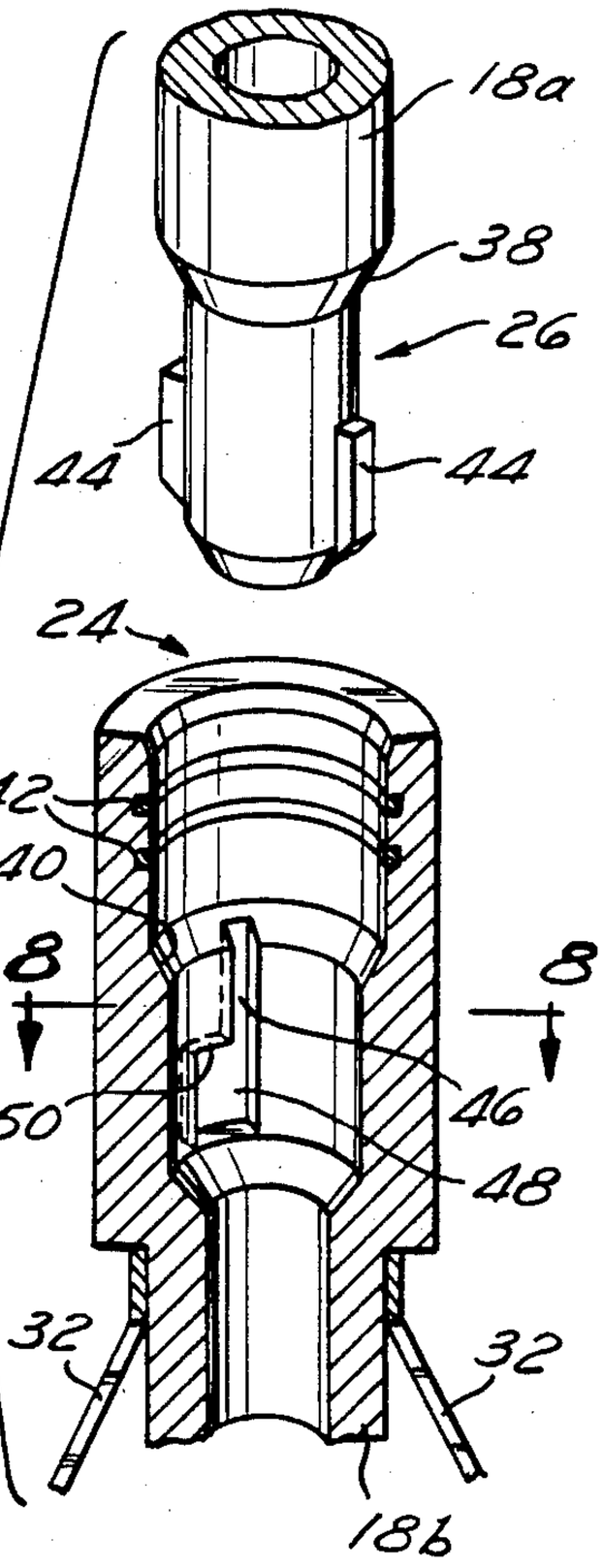


Fig. 7

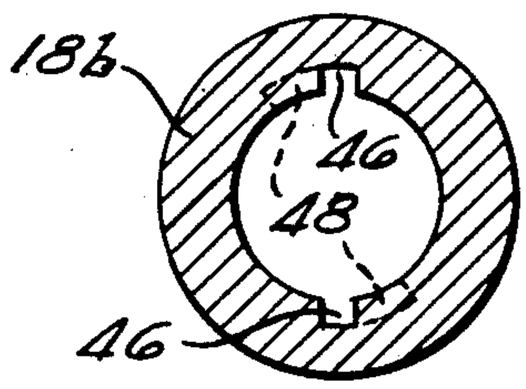


Fig. 8

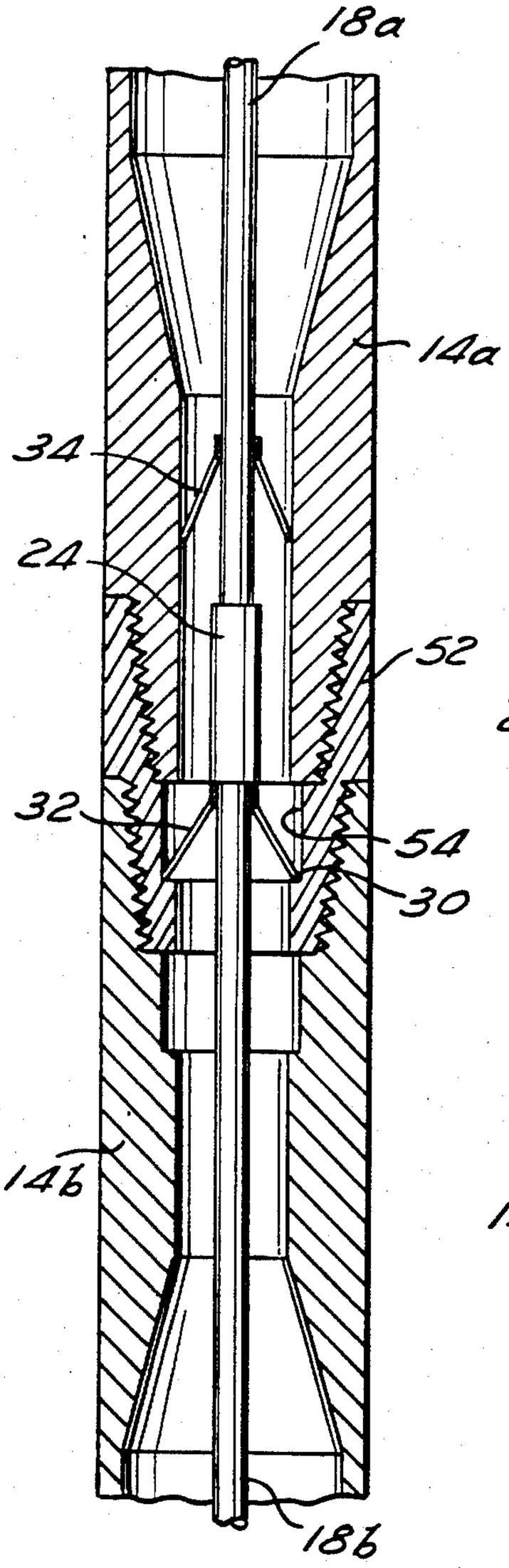


Fig. 9

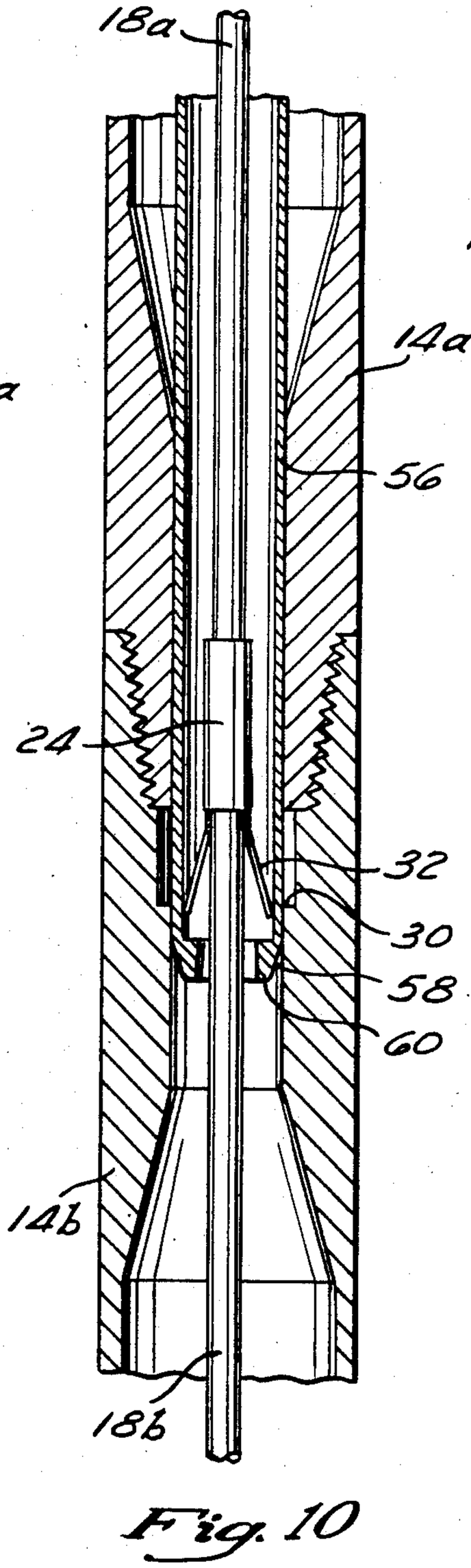


Fig. 10

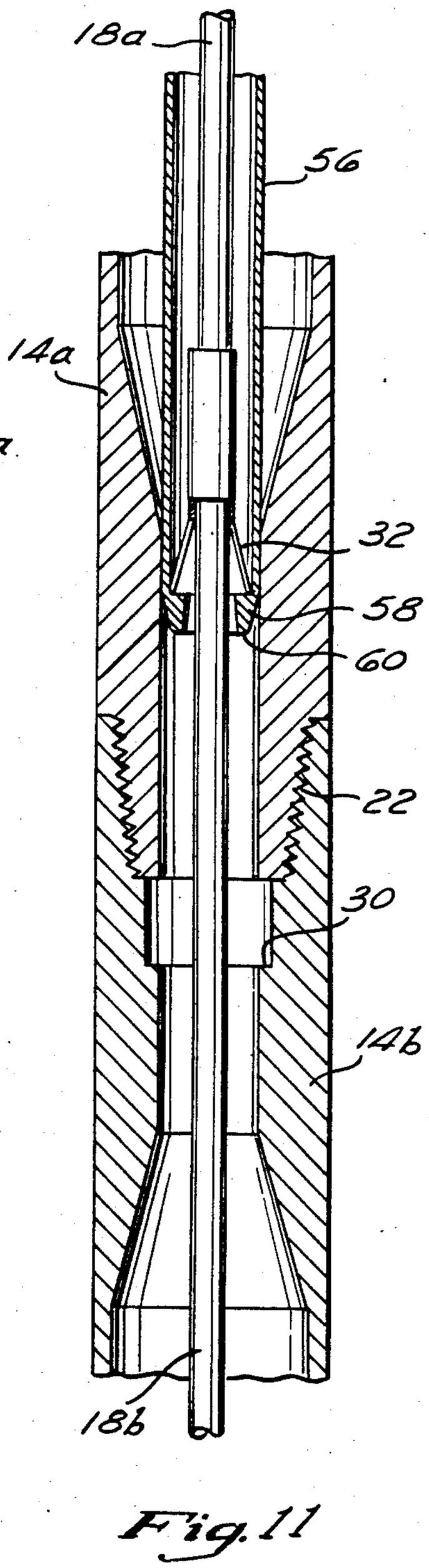


Fig. 11

METHOD AND APPARATUS FOR REMOVING THE INNER CONDUIT FROM A DUAL PASSAGE DRILL STRING

RELATED APPLICATION

The present application is a continuation-in-part of U.S. application Ser. No. 661,368, filed Oct. 16, 1984, now U.S Pat. No. 4,624,327 entitled "Method and Apparatus for Combined Jet and Mechanical Drilling."

BACKGROUND OF THE INVENTION

The present invention relates to a method and apparatus for easily and quickly removing the inner conduit of a dual passage drill string used in drilling geothermal, gas, or oil wells, and, more particularly, to a system and method for removing an inner conduit which is used to deliver high pressure fluid to a drill bit in combined mechanical and jet drilling operations. Although the invention is described herein in connection with geothermal, gas, and oil well drilling, the principles and concepts disclosed apply equally to other forms of drilling and mining.

In oil and gas well drilling, the cost of equipment and labor is extremely high. In order to minimize the cost of this phase of oil and gas production, it is desirable to drill wells through earthen formations as rapidly as possible, commensurate with good drilling practices. However, in harder formations, which are more difficult to drill, there are a number of operating problems that tend to make the cost of such holes more expensive.

In order to increase the drilling rate of deep, hard-to-drill wells, new technology has been developed. For example, it has been shown in previous tests that high pressure fluid jets at 12,000 pounds per square inch (PSI) or more at the drill bit can significantly increase drilling rates. Previously, this high pressure fluid was delivered to the drill bit by pressurizing the entire drilling fluid stream (or "mud"), and conducting it to the drill bit through standard drilling pipe having improved seals at their connections. However, the costs associated with raising such a large volume of fluid to high pressures, together with the increased internal pressures on the seals and drill pipe connections, led to drill pipe failures, significant down time, and increased costs, even though drilling rates were higher. Thus, these attempts at jet drilling proved to be impractical.

Recently, Flow Industries, Inc., assignee of the present application, devised a dual conduit approach for successfully utilizing the principles of jet drilling. In this approach, described in more detail and claimed in copending application Ser. No. 661,368, U.S. Pat. No. 4,624,327, filed Oct. 16, 1984, and entitled "METHOD AND APPARATUS FOR COMBINED JET AND MECHANICAL DRILLING", which is hereby incorporated by reference, a high pressure liquid is conducted via an inner conduit to the drilling bit to provide either a jet assisted mechanical drill or a mechanically assisted jet drill. The drilling mud is delivered to the drill bit in the annulus between the inner conduit and the outer conduit or standard drill pipe. This approach overcomes the problems faced in previous jet drilling methods, although it does require a dual conduit drill string.

Dual conduit drill string presently available is manufactured so that the inner conduit is an integral part of the outer drill pipe, and is therefore unremovable with respect thereto. Thus. it is impossible to pull the inner conduit out of the outer drill pipe while the latter remains in the well. This situation is a serious disadvantage under certain conditions where servicing or repair of the drill pipe is necessary.

Occasionally, the drill pipe breaks. In order to reduce cost, as much of the drill string as possible is salvaged. Thus, the drill string must be cut off at the appropriate depth and removed. In order to accomplish this salvaging operation, certain tooling must be inserted down into the drill pipe. With the inner conduit in place, however, the salvage operation is severely hampered. On other occasions, the drill pipe may be stuck in the hole and cannot be moved either way. A small explosive charge may then be detonated in the hole in order to break the drill pipe at a threaded connection, again in order to save as much of the drill pipe as possible. At other times, articles become caught in the drill pipe and must be fished out. In all of these situations, the existence of the inner conduit in the drill pipe impedes and sometimes prevents the salvage or repair operation.

Thus, there is a need for a dual passage drill string in which the inner conduit can be removed independent of the drill pipe.

SUMMARY OF THE INVENTION

The present invention fulfills this need by providing an inner conduit having a resilient hanger mechanism which permits upward vertical movement and rotation with respect to the outer drill pipe, but which prevents downward vertical movement. The dual passage drill string is assembled into the hole in the normal fashion but, under emergency situations, the inner conduit alone can be removed from the hole leaving the drill pipe. An important advantage of the present invention is that the removable inner conduit can be adapted for use with standard drill pipe sections manufactured in accordance with accepted petroleum industry standards, in particular, the standards set forth by the American Petroleum Institute (API).

Standard API drill pipe is manufactured in sections and assembled by means of threaded connections at the well head. The assembled sections then form a drill string which extends to the drill bit in the hole being drilled. In order to adapt the standard API drill pipe sections for use with the removable inner conduit of the present invention, the upper or female end of the drill pipe is counterbored slightly to provide a support ledge. This ledge supports the weight of the inner conduit section associated with each drill pipe section. The inner conduit is literally suspended from the drill pipe at this location. Likewise, the inner conduit is provided with a hanger mechanism which engages the ledge in order to support the weight of the inner conduit within the drill pipe section. The hanger mounted on the inner conduit permits upward movement of the inner conduit relative to the outer drill pipe, as well as rotation, but prevents downward movement with respect thereto. This permits the removal of the inner conduit without removing the drill pipe. The opposite end of the inner conduit is also provided with a guide or centering mechanism which maintains the concentric position of the inner conduit within the annulus of the drill pipe.

The hangers for the inner conduit are preferably constructed from a flat steel material and are carefully machined to close tolerances so that they will appropriately engage the support ledges. The hangers are flexible in a direction toward the inner conduit to permit the

removal of the inner conduit through narrow drill pipe passageways, but sufficiently rigid to prevent the downward movement of the inner conduit beyond the location of the support ledge. Preferably three or four of the hangers are utilized on each inner conduit section, although other quantities or configurations can also be successfully utilized in the hanger mechanism.

Each inner conduit section is assembled within a drill pipe section for use in forming the overall drill string. The inner conduit is dimensioned such that, as an upper drill pipe section is threadedly engaged with a lower drill pipe section, the lower end of the inner conduit of the upper drill pipe section simultaneously mates with the upper end of the inner conduit of the lower drill pipe section. These two mating ends of the inner conduit engage in a stab joint which is sealed by a pair of annular seals. Because the hangers on the lower inner conduit prevents downward movement, a secure stab joint connection can be made as the drill pipe sections are connected.

Thus, an important advantage of the present invention is that the drill pipe sections are assembled in a normal fashion, just as a single passage drill string is assembled. If it should become necessary to remove the inner conduit from the drill string, the inner conduit sections are rotated relative to the outer drill pipe, which remains in place, and the inner conduit is lifted out. The rotation of the inner conduit, which is permitted by the hanger/support ledge engagement, causes the individual sections of inner conduit to lock onto one another at their joints by means of a locking socket or key lock.

Standard API drill pipe sections are manufactured in lengths varying from approximately 27 to 32 feet. In order to permit the manufacture of removable inner conduits of a uniform length, another aspect of the present invention comprises adaptor subassemblies for modifying the length of the drill pipe. The adaptors can be attached to the standard API drill pipe at their upper ends and are counterbored to provide the support ledge from which the hangers of the inner conduit are suspended. In yet another aspect of the present invention, if the inner conduit should become damaged or, for whatever reason, should fail to lock together, a removal tool can safely and quickly remove the entire inner conduit from the drill string. This removal tool comprises a hollow pipe having a tapered nose and circumferential lip at its distal end. The removal tool is inserted into the drill string so as to be concentric with the inner conduit and in the annulus between the inner conduit and the outer drill pipe. The pipe causes the hangers to flex inwardly so that the tapered nose is passed below the hangers at the point of removal. The hangers then spring outward again to engage the lip. The removal tool can then be lifted from the drill pipe, at the same time lifting the entire inner conduit string from the hole.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is an overall perspective view of the dual passage drill string of the present invention which is used in a variety of drilling operations, with the outer drill pipe partially cut away to reveal the removable inner conduit.

FIG. **2** is a cross-sectional view of a standard drill pipe section which has been slightly modified to receive the removable inner conduit of the present invention.

FIG. **3** is a cross-sectional view of a threaded drill pipe joint illustrating the removable inner conduit therein and the lockable stab joint formed between a pair of inner conduit sections.

FIG. **4** is similar to FIG. **3** and illustrates in cross-section a drill pipe joint with the inner conduit being subjected to an upward removal force.

FIG. **5** is similar to FIGS. **3** and **4** and illustrates in cross-section a drill pipe joint with the inner conduit completely removed.

FIG. **6** is an exploded partial cross-sectional view of the drill pipe joint illustrating the details of the hangers and the lockable stab joint of the inner conduit.

FIG. **7** is an exploded perspective view of the mating members of the inner conduit stab joint and illustrating the locking mechanism for said joint.

FIG. **8** is a cross-sectional view of the female member of the inner conduit stab joint illustrating the keyway and locking socket.

FIG. **9** is another cross-sectional view of a threaded drill pipe joint which has been modified to receive an adapter sub for providing a drill pipe section of a uniform length.

FIG. **10** is a partial cross-sectional view of a drill pipe joint illustrating the use of a removal tool.

FIG. **11** is similar to FIG. **10** and illustrates the removal of the inner conduit by means of the removal tool.

DETAILED DESCRIPTION OF THE INVENTION

FIG. **1** illustrates a standard drill string **10** and drill bit **12** used in the drilling of holes for geothermal, gas, oil, and other wells. The drill string **10** is suspended from the support structure at the top of the well (not shown) and is rotated by machinery in order to permit the drill bit **12** to advance the depth of the hole. The drill string **10** shown in FIG. **1** is comprised of a series of interconnected drill pipe sections **14** which are threadably connected at the drill pipe joints **16**. These drill pipe sections **14** are manufactured in accordance with standards set forth by the American Petroleum Institute (API) and come in lengths ranging from 27–32 feet.

As shown in FIG. **1**, the present invention contemplates a removable, high pressure inner conduit **18** situated within the outer drill pipe **14** for delivering a high pressure fluid to the drill bit **12** for use as a jet drill. In accordance with standard drilling practices, the drilling fluid or "mud" is delivered to the drill bit **12** in the annulus between the inner conduit **18** and the drill pipe **14**. The high pressure fluid and drilling mud mix at the bottom of the hole and are forced upward at low pressure in the annulus between the drill pipe **14** and the casing of the hole. As explained above, it is occasionally necessary, sometimes under emergency conditions, to conduct certain maintenance or salvage operations on or in the drill pipe **14**. Under these conditions, it is an important advantage to be able to remove the inner conduit **18** independently of the outer drill pipe **14**.

FIG. **2** illustrates a standard API drill pipe section **14** which has been modified to receive the removable inner conduit **18** of the present invention. The drill pipe section **14** is comprised of an upper female threaded connector **20** and a lower male threaded connector **22**. The inner conduit **18** also has an upper female connector **24** and a lower male connector **26**. As the depth of the hole increases, additional drill pipe sections are added to the drill string at the top of the hole by means of these threaded connections **20** and **22**. At the same time, the

inner conduits **18** associated with each drill pipe section **14** form a lockable stab joint connection by means of these connectors **24** and **26**, the details of which will be described below. As shown in FIG. **2**, the walls of the drill pipe **14** are thickened in the vicinity of the threaded ends **20** and **22** to provide additional strength and support for the joint connections. These thickened wall areas produce a relatively narrower passageway **27** at each end.

The standard API drill pipe **14** shown in FIG. **2** is modified by counterboring or drilling the upper passageway **27** as indicated at **28** to provide an annular support ledge **30**. The removable inner conduit **18** is provided with a plurality of hangers **32**, two of which are illustrated in FIG. **2**. Preferably, the hangers **32** comprise finger-like, flat metallic springs which engage the support ledge **30**, thereby suspending the inner conduit **18** within the drill pipe **14**. The hangers **32**, of which there may be three, four or more associated with each inner conduit section, are rigidly attached to the inner conduit **18** whose weight is supported by the engagement between the hangers and the support ledge **30**. The hangers **32** are sufficiently rigid to support the weight of the inner conduit **18** without flexing, thereby preventing the downward movement of the inner conduit **18**. However, if necessary, the hangers **32** can flex inwardly, toward the inner conduit **18**, in order to permit the removal of the inner conduit string through passageways **27** which have a smaller diameter than that of the support ledge **30**. The length and taper of each hanger **32** also facilitates this removal and inward flexing. That is, the length of each hanger **32** is approximately twice the greatest distance that the hanger extends away from the inner conduit. The hangers **32** also serve to center the inner conduit **18** within the drill pipe **14**, a function which is accomplished at the lower end of the inner conduit by the centering guides **34**. Each centering guide **34** is constructed similarly to the hangers **32** and engage the narrow passageway **27** at the bottom of the drill pipe **14**.

FIGS. **3–5** illustrates the manner in which the inner conduit can be removed from the drill string. FIG. **3** illustrates a threaded drill pipe joint **16** formed between the male connector **22** of an upper drill pipe section **14***a* and the female connector **20** of a lower drill pipe section **14***b*. As this drill pipe joint **16** was formed, a stab joint **36** was formed between the male connector **26** (not shown in FIG. **3**) of an upper inner conduit **18***a* and the female connector **24** of a lower inner conduit **18***b* in a manner described below in relation to FIG. **6**. The lower inner conduit **18***b* is shown suspended within the lower drill pipe **14***b* by means of hangers **32** and ledge **30**. The upper conduit **18***a* is shown centered in the upper drill pipe section **14***a* by means of guides **34**.

It will be appreciated from FIG. **3** that the hangers **32** and centering guides **34** will permit the inner conduit **18** to move upward and rotate relative to the drill pipe **14** without affecting the latter's position. When the inner conduit **18** is subjected to an upward force, as shown in FIG. **4**, the hangers **32**, due to their flexible nature, can spring inward toward the inner conduit **18** in order to pass through the narrow passageways **27** of the drill pipe sections **14**. FIG. **5** illustrates the remaining drill pipe sections **14** after the inner conduit **18** has been completely removed.

A related advantage of the present invention is that it accommodates differences in expansion between the inner conduit **18** and drill pipe **14**. Also, because different loads are exerted on each, the relative motion of the one with respect to the other accommodates such changes and relieves any unnecessary stress on the sections or joints **16** and **36**. At the same time, lugs or other appropriate devices can be added to the hanger/support ledge interconnection in order to prevent unnecessary relative rotation between the inner conduit **18** and drill pipe **14**.

FIG. **6** illustrates in greater detail the hangers **32** utilized to suspend the inner conduit **18** from the support ledge **30** in the drill pipe **14** and the stab joint connection **36** between the mating ends of the inner conduit **18**. FIG. **6** comprises an exploded view of the drill pipe joint **16** in which the male connector **22** of the upper drill pipe **14***a* and associated inner conduit **18***a* is about to be engaged with the female connector **20** of the lower drill pipe **14***b* and its associated inner conduit **18***b*. The lower inner conduit **18***b* is shown supported on the support ledge **30** by means of the hangers **32**, thereby suspending the inner conduit **18***b* within the lower drill pipe **14***b*. As the upper drill pipe **14***a* is threadably engaged in the lower drill pipe **14***b*, the male connector **26** of the upper inner conduit **18***a* also engages the female connector **24** of the lower inner conduit **18***b* to form the stab joint **36**. In completing this connection, the beveled edge **38** near the end of the male connector **26** on the inner conduit **18***a*seats against the beveled edge **40** on the female connector **24** to form the stab joint **36**. A pair of annular, static seals **42** are embedded in the inner walls of the female connector **24** in order to prevent leakage of the high pressure fluid in the inner conduit **18**. In addition, the mating ends of the inner conduit are provided with a dynamic seal.

In order to provide a lockable stab joint **36**, a pair of keys **44** (only one of which is visible in FIG. **6**) are formed on the lower end or male connector **26** of the inner conduit **18***a* which engage a keyway **46** and a locking socket **48** formed on the interior surface of the female connector **24** of the lower inner conduit **18***b*. These mating elements are also shown in the exploded perspective view of FIG. **7** and the keyway **46** and locking socket **48** are shown in the cross-section of FIG. **8**. When the stab joint **36** is completed, the keys **44** are inserted into a pair of longitudinal keyways **46** formed on the inner surface of the female connector **24**. Adjacent each keyway **46** is a locking socket **48** which is capable of receiving the key **44** on the male connector **26** when the later is rotated. The socket **48** forms a shoulder **50** which locks the key **44** beneath it and prevents the upper inner conduit **18***a* from being lifted or removed without lifting the lower inner conduit **18***b*.

Thus, this mechanism locks the stab joint **36** in order to permit the removal of the entire inner conduit string **18** from the drill pipe **14**. Until it is necessary to remove the inner conduit **18**, the stab joint can remain unlocked; that is, non-rotated. However, if an emergency situation arises, or for maintenance purposes, the inner conduit must be removed, this can be accomplished simply by beginning the rotation of the uppermost inner conduit section. This will in turn cause a sequential locking of the inner conduit stab joint connections so that the entire inner conduit string will be locked together and can be completely removed.

FIG. **9** illustrates that aspect of the present invention which permits the removable inner conduit to be constructed in uniform length. Because standard drill pipe sections are not manufactured in uniform lengths, an adaptor subsection **52** is provided which can be thread-

ably engaged with the upper end of the drill pipe section in order to bring it up to a length which is uniform with the inner conduit sections. This adapter **52** is simply threaded onto the lower drill pipe section **14***b* as any other drill pipe section. The passageway **54** in the adapter **52** is also counterbored to form a support ledge **30** which receives the hangers **32** of the inner conduit **18***b*.

FIGS. **10** and **11** illustrate an alternate removal device and method for removing the inner conduit **18** from the drill pipe **14**. If a stab joint **36** of the inner conduit **18** should be unlockable for any reason or fractured, the inner conduit **18** may still be removed by means of a rigid removal pipe or tool **56** which is inserted into the annulus between the inner conduit **18** and the drill pipe **14**. This tool **56** is provided with a tapered nose **58** and circumferential lip **60**. As the tool **56** is inserted down over the inner conduit **18**, the lip **60** engages the hangers **32** and causes them to flex inward toward the inner conduit **18**. The diameter of tapered nose **58** is less than that of the ledge **30**, permitting the tool **56** to pass below the ledge **30**. Thus, the lip **60** eventually passes below the hangers **32**. The hangers **32** then flex outward again and engage the lip **60**, as shown in FIG. **11**. Thus, the removal tool **56** can be lifted upward, at the same time lifting the inner conduit string and removing it from the drill pipe.

In conclusion, the present invention provides a quick and simple method for removing the inner conduit from a dual passage drill string. At the same time, the lockable stab joint connection of the inner conduit can be utilized in association with the standard API drill pipe sections.

What is claimed is:

1. A method for removing the inner conduit from a dual conduit drill string used in drilling holes for geothermal, oil, and gas wells, and the like, to permit use of emergency or salvage procedures, comprising:

a. providing a standard drill pipe section;

b. modifying said standard drill pipe section to form an interior support;

c. engaging an inner conduit section with said interior support;

d. joining the modified drill pipe sections at joints to form a drill pipe string;

e. joining a plurality of said inner conduit sections at lockable joints to form an inner conduit string;

f. locking said lockable inner conduit joints; and

g. exerting an upward force on said inner conduit to remove the entire inner conduit string from said drill pipe string.

2. The method of claim **1**, wherein said locking step comprises the step of rotating said inner conduit sections to lock one to another.

3. The method of claim **1**, further comprising the step of centering said inner conduit section within said modified drill pipe section.

4. The method of claim **1**, further comprising the step of modifying the length of said standard drill pipe section to conform to a uniform inner conduit length.

5. The method of claim **1**, wherein said modifying step comprises the step of counterboring said standard drill pipe to form an interior ledge.

6. The method of claim **5**, wherein said engaging step comprises the step of hanging said inner conduit from said interior ledge.

7. The method of claim **1**, wherein said exerting step comprises the steps of:

a. placing a second conduit over said conduit;

b. connecting said second conduit to said inner conduit; and

c. lifting said second conduit.

8. The method of claim **1**, wherein said engaging step utilizes flexible fingers on said inner conduit, and further comprising the step of flexing said fingers toward said inner conduit to permit removal of said inner conduit from said drill pipe string.

9. A removable inner conduit section adapted for use with an outer drill pipe section, said drill pipe section having a counterbored portion, comprising:

a conduit having upper and lower ends;

means on said conduit for engaging said drill pipe section to support the weight of said conduit within said drill pipe section, said engaging means providing an interference fit between said conduit and said counterbored portion of said drill pipe section, said engaging means being biased away from said conduit and toward said counterbored portion to permit upward movement of said conduit relative to said drill pipe section but preventing downward movment; and

means on said upper and lower ends of said inner conduit for connecting said conduit to other similar conduits to form an inner conduit string, each of said similar conduits having engaging means to provide means for simultaneously removing said inner conduit string in an upward direction.

10. The removable inner conduit of claim **9**, wherein said connecting means comprises means for locking said conduit to said other similar conduits to permit removal of said inner conduit string.

11. The removable inner conduit of claim **10**, wherein said engaging means also permits rotation of said conduit with respect to said drill pipe section and wherein said locking means comprises rotatable locking means.

12. The removable inner conduit of claim **9**, further comprising means for centering said conduit within said drill pipe section.

13. The inner conduit of claim **9** further comprising means for adapting the length of said outer drill pipe sections to conform to the length of said inner conduit.

14. A removable inner conduit adapted for use within the inner diameter of an outer drill pipe section used in drilling holes for geothermal, oil and gas wells, and the like, said inner conduit and drill pipe section forming a dual passage drill string section, comprising:

a conduit having an upper and lower end; and

means on said conduit and extending therefrom for engaging said inner diameter of said drill pipe section to provide a removable interference fit with said drill pipe section for supporting said conduit within said drill pipe section, said interference fit being removable upon the upward movement of said conduit to permit said conduit to be upwardly removed from said drill pipe section.

15. The inner conduit of claim **14** wherein said means on said inner diameter comprises a ledge for receiving said engaging means, said ledge preventing the downward movement of said conduit with respect to said drill pipe section.

16. The inner conduit of claim **14** further comprising means for lifting said conduit from said drill pipe section.

17. The inner conduit of claim **16** wherein said lifting means comprises an outer conduit adapted for use within the inner diameter of said drill pipe section, said

outer conduit having an upper and lower end, and means on the lower end of said outer conduit for engaging said engaging means of said inner conduit.

18. An inner conduit section used in the drilling of holes for geothermal, oil and gas wells, and the like, and adapted for attachment to a next adjacent upper conduit section and a next adjacent lower conduit section, each of said conduit sections having an upper end and lower end, said conduit sections forming an inner conduit string adapted for use with an outer drill string, comprising:

an upper end on said conduit for connecting said inner conduit to the lower end of said next adjacent upper inner conduit;

a lower end on said inner conduit for connecting said inner conduit to the upper end of said next adjacent lower inner conduit; and

means on at least one of said ends for rotatably locking said inner conduit to said next adjacent inner conduit to provide means for removing said inner conduit string from said hole said locking means comprising a key and a keyway.

19. A method for removing the inner conduit from a dual conduit drill string used in drilling holes for geothermal, oil, and gas wells, and the like, to permit use of emergency or salvage procedures, comprising:

a. providing an outer conduit section;

b. positioning an inner conduit section within said outer conduit section by means of an interference fit;

c. joining a plurality of outer conduit sections at joints to form an outer conduit string;

d. joining a plurality of said inner conduit sections at lockable joints to form an inner conduit string;

e. locking said lockable inner conduit joints; and

f. exerting an upward force on said inner conduit to remove the entire inner conduit string from said outer conduit string.

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